



# BSR16

60V, 600 mA, PNP switching transistor

24 April 2015

Product data sheet

## 1. General description

PNP switching transistor in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package.

NPN complement: BSR14

## 2. Features and benefits

- Single general-purpose switching transistor
- AEC-Q101 qualified

## 3. Applications

- Switching and linear amplification

## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CE0}$	collector-emitter voltage	open base	-	-	-60	V
$I_C$	collector current		-	-	-600	mA
$h_{FE}$	DC current gain	$V_{CE} = -10\text{ V}$ ; $I_C = -150\text{ mA}$ ; pulsed; $t_p \leq 300\ \mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^\circ\text{C}$	100	-	300	

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	<p>TO-236AB (SOT23)</p>	<p>sym132</p>
2	E	emitter		
3	C	collector		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BSR16	TO-236AB	plastic surface-mounted package; 3 leads	SOT23

## 7. Marking

Table 4. Marking codes

Type number	Marking code [1]
BSR16	T8%

[1] % = placeholder for manufacturing site code

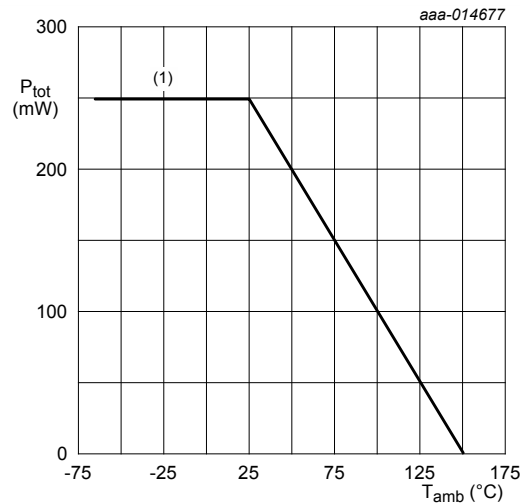
## 8. Limiting values

**Table 5. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
$V_{CBO}$	collector-base voltage	open emitter		-	-60	V
$V_{CEO}$	collector-emitter voltage	open base		-	-60	V
$V_{EBO}$	emitter-base voltage	open collector		-	-5	V
$I_C$	collector current			-	-600	mA
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms		-	-800	mA
$I_{BM}$	peak base current			-	-200	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	250	mW
$T_j$	junction temperature			-	150	°C
$T_{amb}$	ambient temperature			-65	150	°C
$T_{stg}$	storage temperature			-65	150	°C

[1] Transistor mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.



(1) FR4 PCB; standard footprint

**Fig. 1. Power derating curve**

## 9. Thermal characteristics

**Table 6. Thermal characteristics**

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	500	K/W

[1] Transistor mounted on an FR4 printed-circuit board, single-sided copper, tin-plated and standard footprint.

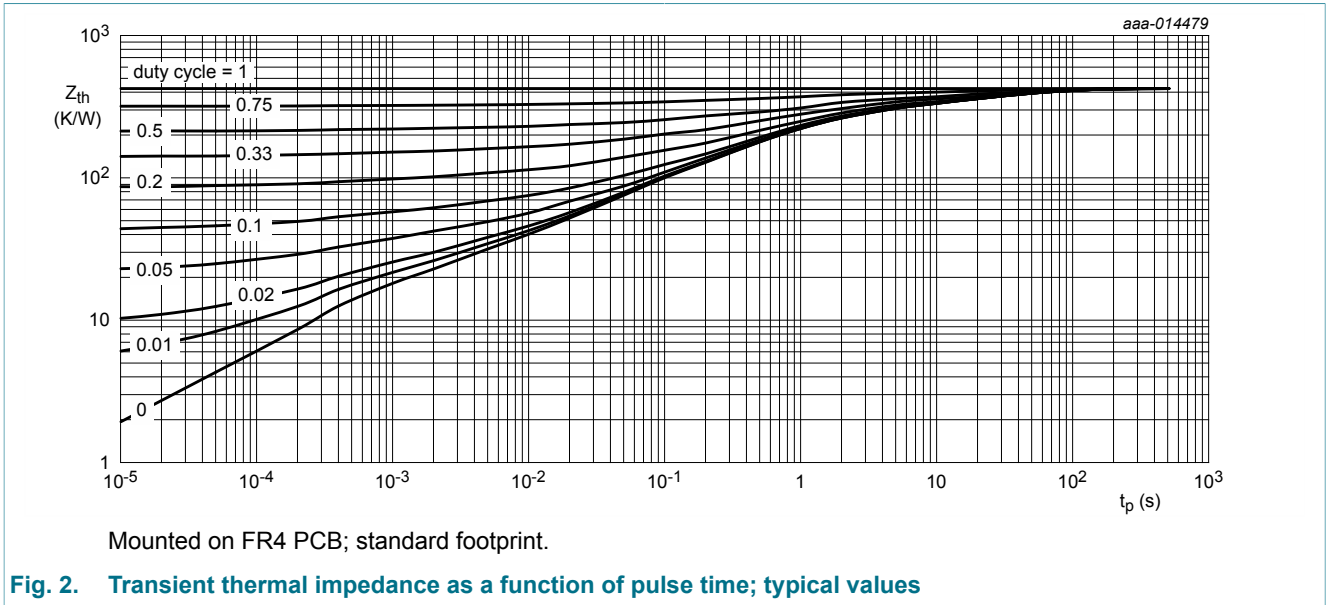
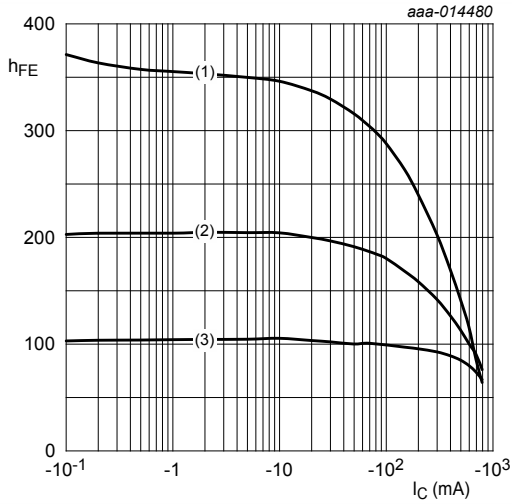


Fig. 2. Transient thermal impedance as a function of pulse time; typical values

## 10. Characteristics

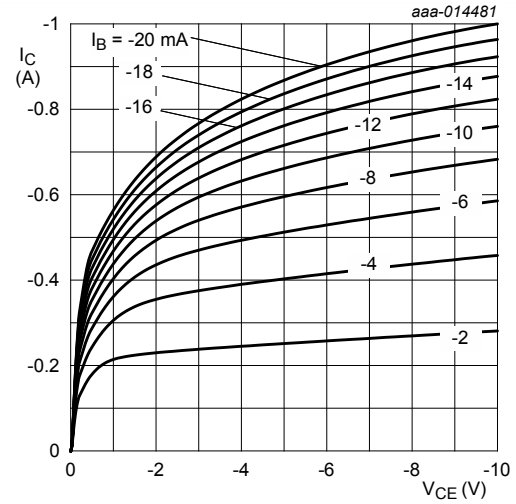
Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -50\text{ V}; I_E = 0\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	-10	nA
		$V_{CB} = -50\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^\circ\text{C}$	-	-	-10	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = -5\text{ V}; I_C = 0\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	-50	nA
$h_{FE}$	DC current gain	$V_{CE} = -10\text{ V}; I_C = -0.1\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	75	-	-	
		$V_{CE} = -10\text{ V}; I_C = -1\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	100	-	-	
		$V_{CE} = -10\text{ V}; I_C = -10\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	100	-	-	
		$V_{CE} = -10\text{ V}; I_C = -150\text{ mA};$ pulsed; $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	100	-	300	
		$V_{CE} = -10\text{ V}; I_C = -500\text{ mA};$ pulsed; $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	50	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -150\text{ mA}; I_B = -15\text{ mA};$ $T_{amb} = 25\text{ }^\circ\text{C}$	-	-	-400	mV
		$I_C = -500\text{ mA}; I_B = -50\text{ mA};$ $T_{amb} = 25\text{ }^\circ\text{C}$	-	-	-1.6	V
$V_{BEsat}$	base-emitter saturation voltage	$I_C = -150\text{ mA}; I_B = -15\text{ mA};$ $T_{amb} = 25\text{ }^\circ\text{C}$	-	-	-1.3	V
		$I_C = -500\text{ mA}; I_B = -50\text{ mA};$ $T_{amb} = 25\text{ }^\circ\text{C}$	-	-	-2.6	V
$t_d$	delay time	$I_C = -150\text{ mA}; I_{Bon} = -15\text{ mA};$ $I_{Boff} = 15\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	12	ns
$t_r$	rise time		-	-	30	ns
$t_{on}$	turn-on time		-	-	40	ns
$t_s$	storage time		-	-	300	ns
$t_f$	fall time		-	-	65	ns
$t_{off}$	turn-off time		-	-	365	ns
$C_C$	collector capacitance		$V_{CB} = -10\text{ V}; I_E = 0\text{ A}; i_e = 0\text{ A};$ $f = 1\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	8
$C_E$	emitter capacitance	$V_{EB} = -2\text{ V}; I_C = 0\text{ A}; i_c = 0\text{ A}; f = 1\text{ MHz};$ $T_{amb} = 25\text{ }^\circ\text{C}$	-	-	30	pF
$f_T$	transition frequency	$V_{CE} = -20\text{ V}; I_C = -50\text{ mA}; f = 100\text{ MHz};$ $T_{amb} = 25\text{ }^\circ\text{C}$	200	-	-	MHz



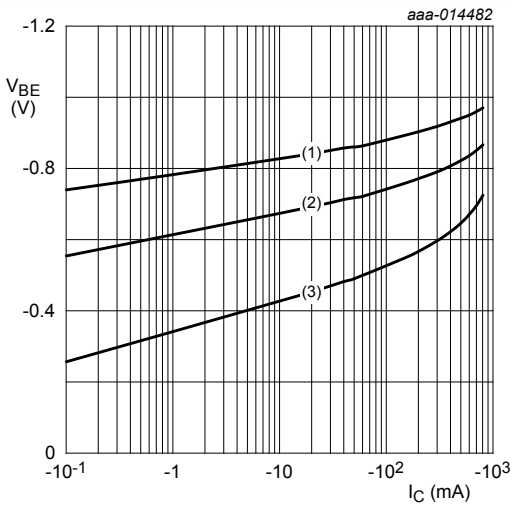
$V_{CE} = -10 V$   
 (1)  $T_{amb} = 150^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = -55^\circ C$

Fig. 3. DC current gain as a function of collector current; typical values



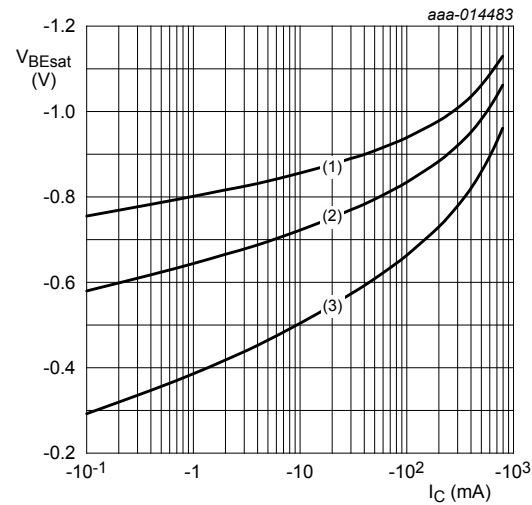
$T_{amb} = 25^\circ C$

Fig. 4. Collector current as a function of collector-emitter voltage; typical values



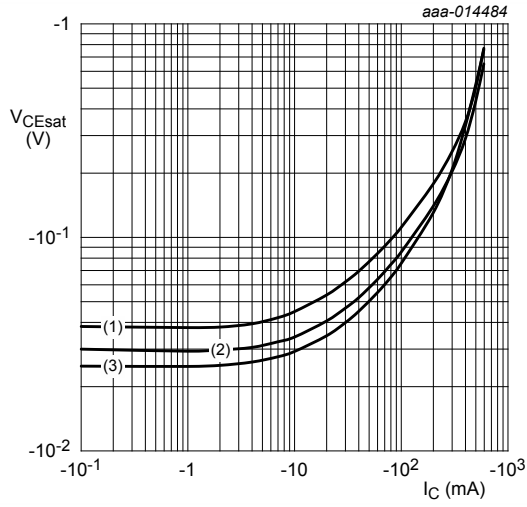
$V_{CE} = -10 V$   
 (1)  $T_{amb} = -55^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = 150^\circ C$

Fig. 5. Base-emitter voltage as a function of collector current; typical values



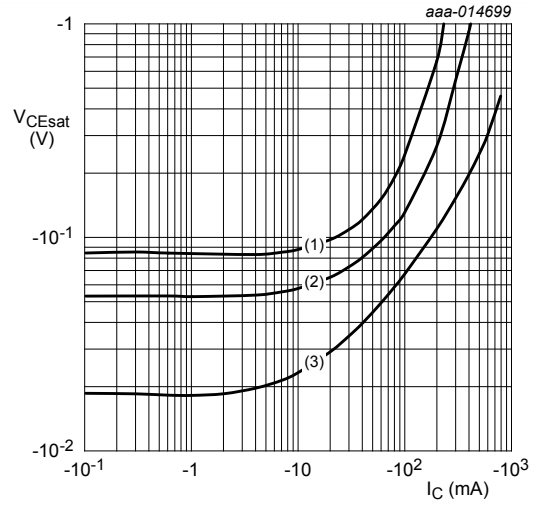
$I_C/I_B = 10$   
 (1)  $T_{amb} = -55^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = 150^\circ C$

Fig. 6. Base-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 20$   
 (1)  $T_{amb} = 150\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig. 7. Collector-emitter saturation voltage as a function of collector current; typical values**



$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

**Fig. 8. Collector-emitter saturation voltage as a function of collector current; typical values**

### 11. Test information

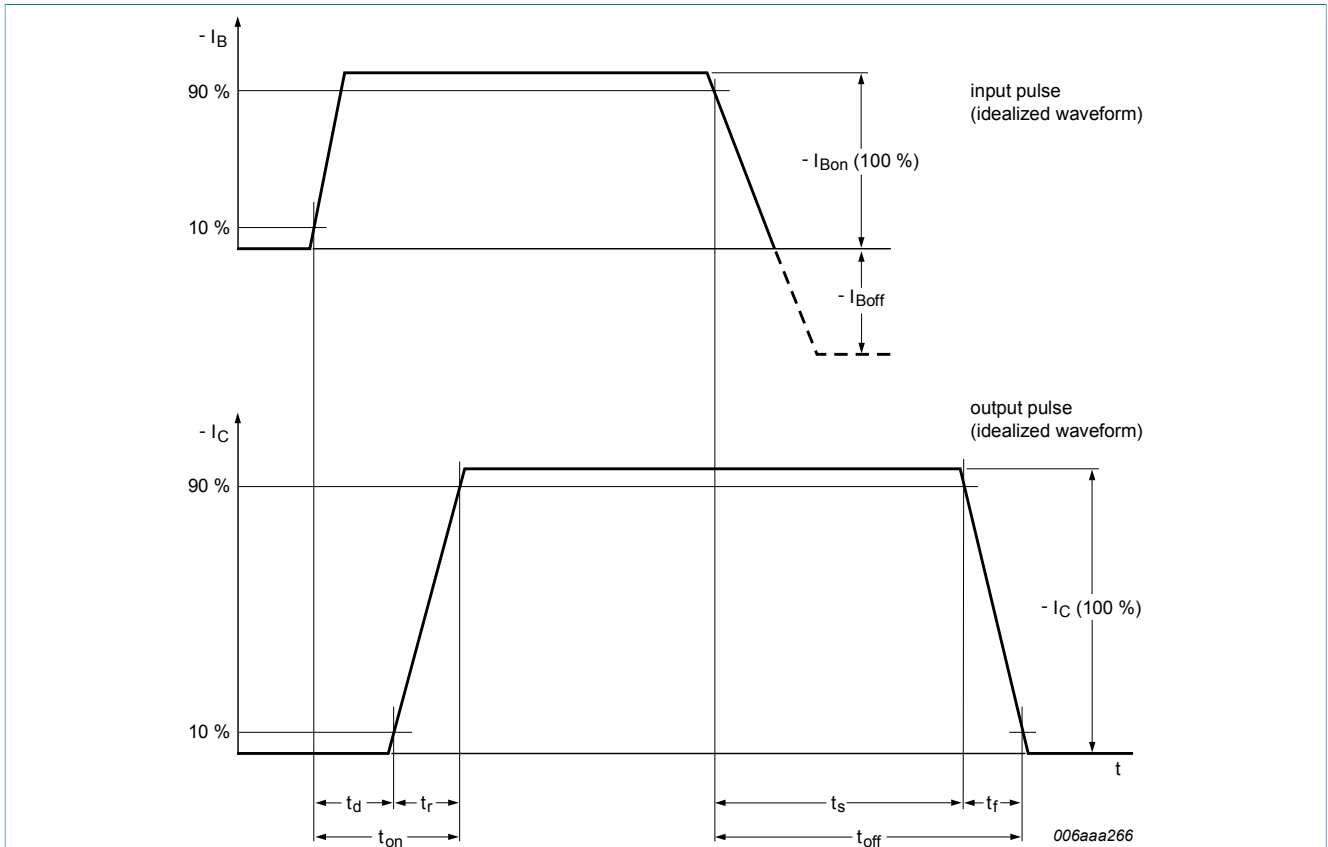


Fig. 9. BISS transistor switching time definition

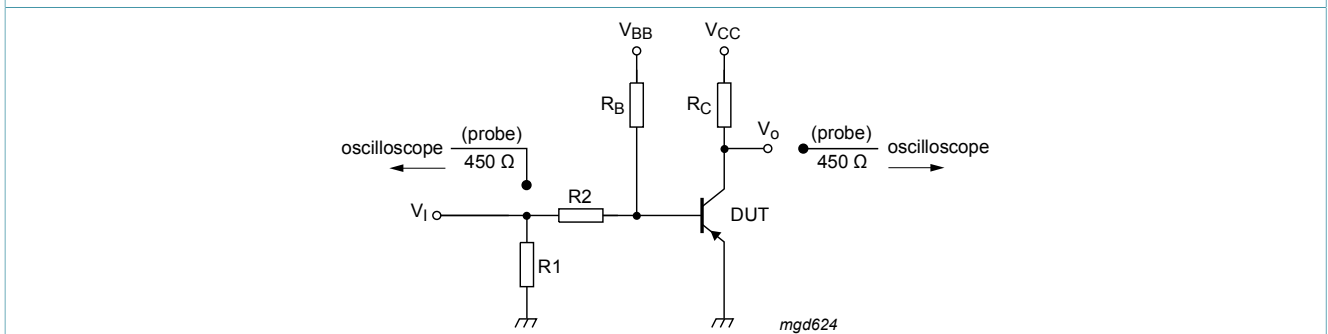


Fig. 10. Test circuit for switching times

#### 11.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - *Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.



## 12. Package outline

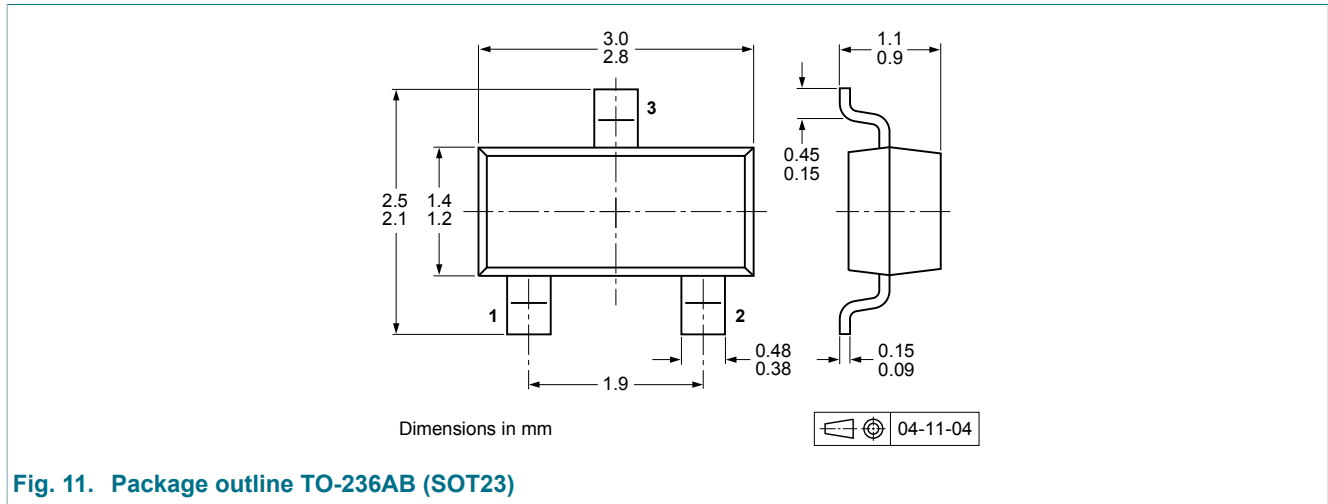


Fig. 11. Package outline TO-236AB (SOT23)

## 13. Soldering

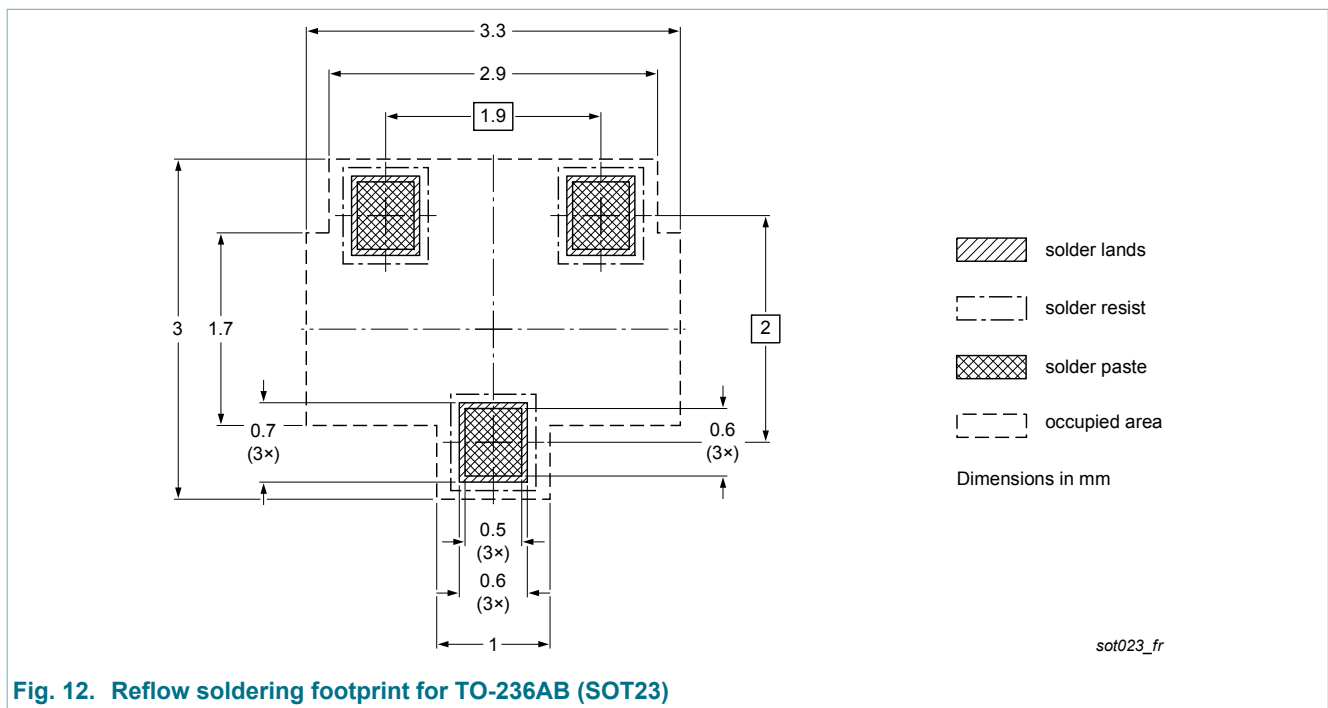


Fig. 12. Reflow soldering footprint for TO-236AB (SOT23)

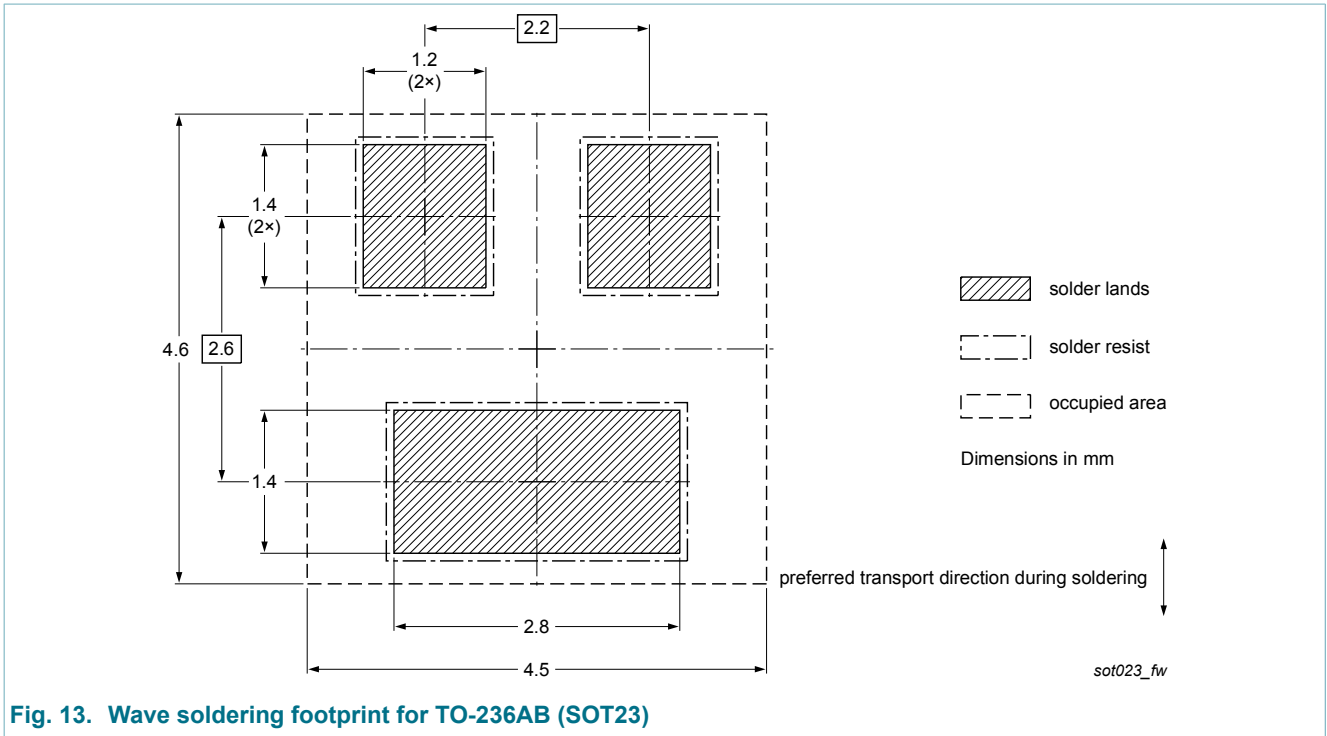


Fig. 13. Wave soldering footprint for TO-236AB (SOT23)

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
BSR16 v.5	20150424	Product data sheet	-	BSR15; BSR16 v.4
Modifications:	<ul style="list-style-type: none"><li>Type BSR15 removed</li><li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors</li><li>Legal texts have been adapted to the new company name where appropriate</li></ul>			
BSR15; BSR16 v.4	20040113	Product data sheet	-	BSR15; BSR16 v.3
BSR15; BSR16 v.3	19990415	Product data sheet	-	-

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### 15.1 Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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